

An intelligently designed response

Scientists are increasingly likely to be called upon to discuss the myth of intelligent design as a scientific theory.

A little more than a year before we celebrate the bicentennial of Darwin's birth, anti-Darwin activism is alive and well. The most insidious movement promotes 'intelligent design' (ID)—the notion that some features in nature are best explained by an intelligent cause—as an alternative scientific theory to evolution by natural selection. A famous court decision in Dover, Pennsylvania, USA in 2005 put a damper on attempts to teach ID in science classes by unambiguously concluding that ID is not science. Nevertheless, the US pro-ID movement continues its campaign to enter the classroom, circumventing legal challenges by encouraging individual teachers to voluntarily discuss the so-called 'scientific theory of design'.

Long considered a North American phenomenon, pro-ID interest groups can also be found throughout Europe. In recent years, incidents of school curricula being altered to include ID have caused alarm in Italy and Germany. A survey conducted in the United Kingdom in 2006 revealed that 41% of respondents thought ID should be taught in science classes. Concern about this trend is now so widespread in Europe that in October 2007 the Council of Europe voted on a motion calling upon member states to firmly oppose the teaching of creationism as a scientific discipline.

With such a backdrop, it becomes increasingly likely for a scientist to be confronted by a pro-ID campaigner or challenged by a student, friend or neighbor intrigued and seduced by the concept of a scientific theory of design. How to respond is not a trivial matter.

One can choose to fully engage in debate and debunk ID claims one by one with scientific arguments. This, however, requires a good knowledge of the topic and the ability to present it effectively to a lay audience. The alternative of squarely dismissing the ID proposal as nonsense is tempting, but it reinforces images, which ID advocates relish, of arrogant scientists dodging critique or even of 'Darwinian activism'. It is also wise not to make the discussion a religious issue to avoid an unproductive debate about personal beliefs.

The best approach, depending on the audience, will often be to accept discussing ID but to emphasize the fact that it is not a scientific discipline. At the core of ID is the notion of 'irreducible complexity', which postulates that some features in nature are too complex to have evolved in a step-wise fashion by natural selection

and 'therefore' must be the result of an intelligent cause. Because it invokes a supernatural origin for something one cannot yet explain, and because it does not generate testable hypotheses and cannot be subjected to empirical inquiry, ID is not science.

Paradoxically, ID proponents often present the theory of evolution as "a sacred dogma that can't be questioned", whereas in fact scientists have been testing evolution empirically for decades. The insistence of ID supporters on presenting evolution as a theory, in the colloquial rather than scientific sense of the term, attempts to bring ID and evolution to the same level. This discourse ignores the existing body of evidence supporting evolution and the ongoing research that continues to examine evolutionary theory.

Notably, the emergence of novel techniques has allowed scientists to approach the study of evolution from different angles, to make new quantifiable predictions and test them experimentally. For example, the ability to sequence whole genomes (including genomes from extinct species like Neanderthal) enables phylogenies to be estimated with new accuracy. Genome sequencing has also facilitated the study and genetic manipulation of non-model organisms, expanding the scope of experimentation on species relatedness and evolution of features. Another new tool is the technique of molecular directed evolution, which can be used, as illustrated in two Commentaries in this issue (p. 991 and 995), to test evolutionary hypotheses by reconstructing 'protein fossils' and probe how protein structural organization relates to function.

Yet another example is the relatively young field of evolutionary developmental biology (nicknamed *evo-devo*), which brings together the mechanistic analysis of individual development and phenotypic change during evolution. This approach—facilitated by the tools of computational modeling, imaging, comparative genomics and epigenetics—allows scientists to formulate and test hypotheses about the mechanisms by which phenotypic features emerge (see the December 2007 issue of *Nature Reviews Genetics*).

Evolution is a scientific theory—one that has stood the test of time and of multiple lines of empirical investigation. Intelligent design is not. Remembering this contrast should inspire scientists to defend their turf. At the core of the debate is the definition of science itself.